THE final settlement of the estate of Archibald Henry Blount, of England, who sometime ago made Yale University his residuary legatee, shows that the university will receive net from the estate the sum of $328,752. In the settlement of the estate there has been paid out $8,539 for the university's legal expenses in the matter, and about $70,000 as an inheritance tax to the English Government.

THE Ontario legislature has passed a resolution permitting Toronto University to take advantage of the Carnegie Foundation's pension fund. The legislature of Nebraska has refused permission to the state university.

IT is announced that Columbia University will establish a course in forestry leading to the degree of forest engineer. The plan will probably be put into effect next year though the special work would not begin for two more years.

A BILL has been introduced in the New York legislature amending the educational law by providing for the establishment of a State School of Sanitary Science and Public Health at Cornell University.

THREE departments of Sibley College, Cornell University—those of marine engineering, naval architecture and railway mechanical engineering—have been discontinued. This action has been nearly coincident with the departure from Cornell of the heads of two of the departments, Professors C. C. Thomas and H. Wade Hibbard. But these professors did not go because their departments had been or were to be abolished, nor was their departure the cause of the termination.

THE academy in Neuenburg, Switzerland, is to become a university.

THE Egyptian government has in view the establishment of a national university. The theological students at Cairo have recently petitioned for competent teachers of modern science.

AT a recent meeting of the faculty of Wesleyan University, two committees were appointed to act with those of the trustees. One in regard to the establishment of a separate college for women has Professors Rice, Winchester, Harrington, Nicolson and Bradley as members; the other, which will help fix the date of the inauguration of President Shanklin, consists of Professors Rice, Winchester and Crawford.

ACCORDING to the *Umschau* there are this semester 1077 regularly matriculated women students in the German universities as compared with 140 three years ago.

AT the meeting of the board of trustees of Stanford University, on March 5, the following promotions in rank to take effect with the beginning of the academic year 1909–10 were made: To the rank of professor: Frank Mace McFarland, in histology; John Flesher Newsom, in mining; Harold Heath, in zoology; Arthur Martin Cathcart and Wesley Newcomb Hohfeld, in law; James Farley McClelland, in mining engineering; Guido Hugo Marx, in machine design; Henry Waldgrave Stuart, in philosophy. To the rank of associate professor: Karl G. Rendtorff and William Alpha Cooper, in German; Lillian Jane Martin, in psychology; Raymond Macdonald Alden, in English; William Rankine Eckart, in mechanical engineering; Halcott Cadwalader Moreno and Sidney Dean Townley, in applied mathematics; Charles Andrews Huston and Joseph Walter Bingham, in law. To the rank of assistant professor: Payson Jackson Treat, in history; Mary Isabel McCracken and Rennie Wilbur Doane, in entomology; Walter Kenrick Fisher, in zoology; James Pearce Mitchell, in chemistry; Leonas Lancelot Burlingame, in botany.

DR. R. S. WOODWORTH, adjunct professor of psychology in Columbia University, has been promoted to a professorship of psychology. Mr. H. H. Woodrow has been appointed tutor in psychology at Barnard College.

DR. LUDWIG MESSER, associate professor of philosophy at Giessen, has accepted a call to the University at Buenos Ayres.

DISCUSSION AND CORRESPONDENCE

ADULTERATION AND THE CONDITION OF ANALYTICAL CHEMISTRY AMONG THE ANCIENTS

IN an address of Mr. W. D. Richardson published in SCIENCE last year, attention is called

to the very speculative condition of ancient science. Mr. Richardson remarks that "Ancient records and books are extremely few in number, and worse than that, the scientific writings, when they are not purely speculative, are quite unreliable." This statement, while undoubtedly true, in a certain sense seems to me open to criticism in that it is apt to give one an entirely mistaken idea of what classic writers have recorded regarding the achievements of the ancients in practical chemistry. As a matter of fact, enough reliable practical chemical knowledge has come down to us in the writings of Pliny, Dioscorides and others to form a very respectable treatise. The "Natural History" of Pliny, for example, is completely interwoven with little digressions upon what is now termed the "chemistry of every-day life" and the reader is often surprised to run across statements, which might have been taken from some modern work, such, for example, as references to the use and well-recognized efficiency of burning sulphur for fumigating and purifying the interior of dwellings (book 25, ch. 50), or to the use of suspended cords upon which to crystallize substances (book 34, ch. 32), or to the lowering of a burning light into wine vats to determine whether or not it was safe for workmen to descend in order to remove the lees. "As long as the light refuses to burn it is significant of danger" (book 23, ch. 31). Pliny's book is filled with such little practical points as these, all of which, together with his description of many technical processes in which the Romans were recognized masters, such as the mixing of mortars and cement, the manufacture of white lead and other pigments, the fermentation of wine, the use of legumes in crop-rotation, etc., serve as a most striking commentary upon the manner in which the practise of a science may anticipate the dictates of its theory—even by thousands of years. Much of the matter which Pliny has gleaned in his "Natural History" was common knowledge centuries before his time. The use of burning sulphur as a disinfectant, for example, is mentioned in the "Odyssey" of Homer (book 22, ch. 481). Odysseus, after the murder of the suitors, cries out to his aged nurse: "Bring sulphur, old woman, the cleanser of pollution and bring me fire, that I may sulphur the chamber."

The science of the ancients was extremely weak, however, upon its analytic side and in the course of its whole history may be said to have produced but one mind truly great in this respect—that of Archimedes. This philosopher and experimenter by his method of displacement was the first to establish a physical constant—that of specific gravity—and the first to apply such a constant to certain analytical problems as in the well-known example cited by Vitruvius, where Archimedes determined the purity of the gold in King Hiero's votive crown.

The application of specific gravity to the testing of various bodies, liquid as well as solid, seems to have been common after the time of Archimedes. Pliny (book 31, ch. 23), in fact, alludes to the use of some form of specific gravity balance (Statera) by which the purity of water could be tested.

The search for a means to detect adulteration was what led Archimedes to his epoch-making discovery and this we will find to be always a leading stimulus in the development of analytical chemistry in ancient as well as in modern times. The adulteration of foods and other commodities of life was as common in the early days of the Roman Empire as it is to-day. Pliny repeatedly calls attention to the many frauds of his time. "It is the natural propensity of man to falsify and corrupt everything," he exclaims while writing of the adulteration of honey, and again, when speaking of the use of gypsum, pitch, lime, rosin, wood ashes, salt, sulphur, artificial pigments, etc., for treating wines (book 14, ch. 25), he cries out: "By such poisonous sophistications is this beverage compelled to suit our tastes, and then we are surprised that it is injurious in its effects!" Pliny blames the druggists especially for their practises in this respect and is most bitter in his denunciations of the whole fraternity of Roman apothecaries. Many pages of the "Naturalis Historia" are in fact devoted to the disclosure of the

"shady" practises carried out in the shops of the ancient druggists (tenebræ officinarum).

In the long list of tests, which Pliny enumerates for detecting the various forms of adulteration practised in his time, by far the greater number relate to the use of our simplest sense perceptions, such as taste, smell, color, feel, brittleness, etc. The ancients guided by such perceptions were unquestionably better judges of the purity of many articles of food than we are to-day. Pliny in fact, makes such a fine classification of tastes and flavors (book 15, ch. 32) that the translator finds himself at a loss for suitable terms in which to express the meaning. Whether this indicates an over-refinement of the taste perception among the Romans through the influence of a long line of epicures dating from Lucullus, or simply an atrophy of our present powers in this respect, would be difficult to say. Professional tasters (book 14, ch. 8) were in demand during the early days of the Roman empire to determine the quality of wines, and notwithstanding our advanced chemical knowledge of the score or more esters which give wines their characteristic bouquet, the final criterion in the judgment of a wine, now as in the days of Pliny, is the evidence of a skillful taster.

But the ancients had many other means of testing the purity of their commodities of life than those of simple taste and smell; and it is worth our while to examine a few of these, for they mark in reality the first beginnings in the development of the science of analytical chemistry. A good illustration of such tests is given under Pliny's description of Balsam (book 12, ch. 54).

Balsam in a genuine state should be quite hard, but when it is mixed with gum a brittle pellicle forms upon it. The fraud can also be detected by the taste and when placed upon hot coals it may easily be seen if there has been any adulteration with wax and rosin, for the flame in this case burns with a blacker smoke than when the balsam is pure. In addition to these various tests a drop of pure balsam, if placed in luke-warm water, will settle to the bottom of the vessel, whereas, if it is adulterated it will float upon the surface like oil, and if it has been drugged with metopion or ammoniacum, a white circle will form around it. But the best test of all is, that it will cause milk to curdle, and leave no stain upon cloth.

Such tests as the ones cited in this quotation show that the faculty of careful and precise observation was by no means neglected among the ancients.

The flame test to which reference was made, is mentioned repeatedly by Pliny in the testing of drugs and chemicals. In some cases the color and smell of the smoke were observed, in others the color of the flame, or the property of decrepitating.

The formation of a white ring as described by Pliny in his test for adulterated balsam, brings up to the mind of the chemist the innumerable ring tests which are made use of in the laboratory at the present day, as well as the host of color reactions employed in testing food products, drugs and chemicals. We find, in fact, that these color reactions were used very extensively by the ancients, and the mention of one or two others may have a passing interest.

Among the tests given for alum Pliny (book 35, ch. 52) states that it will turn pomegranate juice and nut galls black. Authorities differ somewhat as to the exact nature of the compound that was called alumen by the Romans and στυπτηρία by the Greeks, but all seem agreed that sulphate of iron was present. The tests which Pliny describes are therefore nothing but the familiar tannin reaction with salts of iron.

A most interesting modification of the nut-gall test is described under the subject of verdigris (book 34, ch. 28). Here a piece of papyrus, which had been previously steeped in an infusion of nut galls, is employed for testing, the paper so treated turning black if genuine verdigris is applied. This passage is noteworthy, for so far as I can find it is the first historical reference to the use of test paper.

In a number of instances I have found Pliny to be even wiser than his modern commentators. Pliny gives, for example, as one of the tests for vinegar (book 23, ch. 27) that it has the property of effervescing when poured upon the ground. The editor of one

translation remarks as to this that the vinegar of the present day does not have any such property. If this commentator, however, had had even a little knowledge of chemistry, he might have remembered that the acid of vinegar may cause a considerable effervescence of carbonic acid when brought into contact with chalky or calcareous soils.

In testing the purity of minerals and precious stones the ancients seem to have acquired considerable dexterity. The use of the touch-stone (Coticula) for determining the purity of precious metals and their ores was well known to the Romans and employed with such accuracy, according to Pliny (book 33, ch. 43), that the proportion of gold, silver or copper could be told instantly, even to the smallest fraction. In detecting the imitation of gems and precious stones—concerning which Pliny (book 37, ch. 75) states that most colossal deceptions were practised and in no other kind of fraud greater profits made—the ancients were in many ways as skillful as the jewelers of to-day. They employed the balance, tested certain optical properties, and even used a scale of hardness (book 37, ch. 76), it being recognized that some stones could be scratched with a blunt knife, while others could not be marked with the hardest obsidian.

Lack of space forbids giving other examples of the methods employed by the ancients in testing the purity of the commodities of life. The examples cited however show that the fragmentary records of ancient science preserved by Pliny, full as they are of inaccuracies and absurdities, contain a large amount of reliable chemical knowledge. And if the 474 authors whom Pliny consulted in the preparation of his "History" had come down to us intact we may be sure that our knowledge not only of historical, but also of practical, chemistry would be greatly enriched.

C. A. Browne

New York

EVOLUTIONARY COLLECTIONS AS MONUMENTS TO DARWIN

To the Editor of Science: In connection with the recent announcements that special collections in honor of Darwin are to be formed at the American Museum of Natural History, and that Haeckel intends to devote the remainder of his life to his phylogenetic museum, I venture to call attention to the subjoined selections from my address, "Educational Museums of Vertebrates," before the Biologic Section of the American Association for the Advancement of Science in 1885 (see the *Proceedings*, vol. 34, and abstract in Science, September 11, 1885):

> A statue of Darwin has been unveiled in London with honorable ceremonies. What monument to his memory could be more appropriate or lasting than the formation, in all educational institutions, of collections especially designed to exhibit the facts which he made significant, and the ideas which his knowledge, his industry and his honesty have caused to underlie the intelligent study of nature throughout the world. Such collections should particularly embrace series illustrating human peculiarities, not only as to skeleton, but as to brain, heart and other organs; human resemblances to mammals in general; features that unite man with the tailless apes, and separate them from all other mammals; transitory human organs and conditions that resemble the permanent organs and conditions of other mammals, especially apes; human anomalies resembling the normal structure of apes; anomalies and malformations affecting man and other vertebrates in a similar manner; apparently useless or detrimental organs or conditions.

Burt G. Wilder

Ithaca, N. Y.,
February 13, 1909

QUOTATIONS

THE FUTURE OF YALE

If I were president of Yale! But that is inconceivable. I was never in the hereditary line of descent. Besides I stepped out of all other lines that tend toward New Haven when, forty years ago, after getting more or less ready for Yale, I went as a pioneer to untried Cornell. I went because botany and geology and European history at Cornell counted for as much as Latin or Greek; and now I have to take the consequences.